HYBRID AUTOMATIC REPEAT REQUEST IN COMMUNICATIONS

FIELD OF THE INVENTION

[0001] The exemplary and non-limiting embodiments of this invention relate generally to wireless communications networks, and more particularly to hybrid automatic repeat request (HARQ) signalling.

BACKGROUND ART

[0002] The following description of background art may include in-sights, discoveries, understandings or disclosures, or associations together with dis-closures not known to the relevant art prior to the present invention but provided by the invention. Some such contributions of the invention may be specifically pointed out below, whereas other such contributions of the invention will be apparent from their context.

[0003] Hybrid automatic repeat request (hybrid ARQ or HARQ) is a combination of high-rate forward error-correcting coding and ARQ error-control for detectable but non-correctable errors. In hybrid ARQ, a code may be used in order to perform forward-error correction and error detection by correcting a subset of errors while relying on ARQ to correct errors that are non-correctable using only redundancy sent in an initial transmission. HARQ in LTE is based on using a stop-and-wait HARQ procedure. When a packet is transmitted from eNode-B, UE decodes it and provides feedback on PUCCH. A similar procedure takes place in uplink side where a packet is transmitted from UE, and eNode-B decodes it and provides feedback on PHICH (physical HARQ indicator channel).

SUMMARY

[0004] The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

[0005] Various aspects of the invention comprise a method, apparatuses, and a computer program product as defined in the independent claims. Further embodiments of the invention are disclosed in the dependent claims.

[0006] An aspect of the invention relates to a method for hybrid automatic repeat request HARQ signalling in a communications system, the method comprising defining, in a communications apparatus, a link-independent hybrid automatic repeat request HARQ entity for one link direction, wherein the defined entity comprises a resource allocation for one or more of forward link and reverse link data, the resource allocation comprising at least one hybrid automatic repeat request HARQ process having a process identification, each hybrid automatic repeat request HARQ process having a unique HARQ identification, a data allocation having a predetermined timing offset with respect to the resource allocation, and a hybrid automatic repeat request HARQ acknowledgement allocation having a predetermined timing offset with respect to the data allocation, wherein the timing offset of the hybrid automatic repeat request HARQ acknowledgement with respect to the data allocation is determined in terms of time division duplexing TDD frames and independently of a forward link-reverse link ratio.

[0007] A further aspect of the invention relates to an apparatus comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to define, a link-independent hybrid automatic repeat request HARQ entity for one link direction, wherein the defined entity comprises a resource allocation for one or more of forward link and reverse link data, the resource allocation comprising at least one hybrid automatic repeat request HARQ process having a process identification, each hybrid automatic repeat request HARQ process having a unique HARQ identification, a data allocation having a predetermined timing offset with respect to the resource allocation, and a hybrid automatic repeat request HARQ acknowledgement allocation having a predetermined timing offset with respect to the data allocation, wherein the timing offset of the hybrid automatic repeat request HARQ acknowledgement with respect to the data allocation is determined in terms of time division duplexing TDD frames and independently of a forward link-reverse link ratio.

[0008] A still further aspect of the invention relates to a user terminal comprising at least one processor; and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the user terminal to receive and provide feedback related to a link-independent hybrid automatic repeat request HARQ entity defined for one link direction, wherein the entity comprises a resource allocation for one or more of forward link and reverse link data, the resource allocation comprising at least one hybrid autouratic repeat request HARQ process having a process identification, each hybrid automatic repeat request HARQ process having a unique HARQ identification, a data allocation having a predetermined timing offset with respect to the resource allocation, and a hybrid automatic repeat request HARQ acknowledgement allocation having a predetermined timing offset with respect to the data allocation, wherein the timing offset of the hybrid automatic repeat request HARQ acknowledgement with respect to the data allocation is determined in terms of time division duplexing TDD frames and independently of a forward link-reverse link ratio.

[0009] A still further aspect of the invention relates to a computer program product comprising program code means adapted to perform any one of the method steps when the program is run on a computer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In the following the invention will be described in greater detail by means of exemplary embodiments with reference to the attached drawings, in which

[0011] FIG. **1** illustrates HARQ timing diagrams for LTE-FDD and LTE-TDD;

[0012] FIG. **2** illustrates UL/DL configurations and downlink association set index for TDD;

[0013] FIG. **3** illustrates a multi-hop scenario comprising separate hop specific HARQ entities;

[0014] FIG. **4** illustrates exemplary UL & DL HARQ signalling;

[0015] FIG. **5** illustrates exemplary HARQ timing;